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CHAPTER SIXTEEN:

GABIONS

Gabions are compartmented rectangular containers made of heavily galvanized steel woven wire that are filled with stone. The gabion is used as a large, flexible, and permeable building block from which a broad range of structures may be built.

Gabions are used for the following:

- 1) Erosion control
 - 2) Channels
 - 3) Earth control
 - 4) Shoreline protection
 - 5) Rockfalls
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FUNCTION

Several features make the gabions suitable for INDOT to use them as erosion control and channel liners. Those features include:

- 1) Flexibility - In the presence of unstable ground and moving water, this unique feature allows a gabion structure to settle and deform without failure and loss of efficiency.
- 2) Strength - The strength and flexibility of the horizontal triple-twist mesh allows gabion structures to withstand the natural forces of flood, torrential flow, and ice and earth pressures.
- 3) Permeability - Gabion structures allow water collecting at the rear to drain through without the aid of an expensive drainage system.
- 4) Durability - Gabions have a very high resistance to atmospheric corrosion due to the well bonded zinc coating on the wire and their ability to support vegetation growth.

Gabion structures may be subjected to various stresses and they are required to be able to settle, twist, and conform to channel and foundation shifts and changes. At the same time, gabions are required to have sufficient strength to contain the weight of the rocks with which they are filled and of additional gabions that may be placed upon them. Gabions also are required to resist the impact force of high velocity currents and soil pressure.

Gabions are required to have the following physical features:

- 1) Hexagonal mesh pattern which under stress deforms but does not break
- 2) Triple-twist which makes the mesh non-ravelling
- 3) Reinforcing wires woven into each corner that increase the strength at the critical points and help the gabion retain shape during and after filling
- 4) A diaphragm securely attached to the base which prevents the shifting of the stone and at the same time reinforces the gabion

INDOT USAGE

INDOT uses gabions for erosion control, revetments, and channel linings.

The dimensions of the gabions (baskets) used for erosion control and channel linings are normally detailed in the plans or proposal. When gabions are used for revetments they are called "revet mattresses" and are only 9 in. in thickness. Only the Specifications for gabions are discussed since both types are similar.

The gabions are required to be made of hexagonal triple twist mesh with heavily galvanized steel wire. The maximum linear dimension of the mesh opening may not exceed 4 1/2 in. The area of the mesh opening is required to not exceed 10 in².

The length of the Gabion is required to be multiples (2, 3, or 4) of the horizontal width. For example, if the basket is 3 ft wide then the length of any basket may be 6 ft, 9 ft or 12 ft. Where the length of the basket exceeds 4 ft, the basket is required to be divided by diaphragms that are the same mesh and gauge as the basket. The diaphragms divide the basket into cells of equal length and width.

Gabions are required to be fabricated in such a manner that the sides, ends, lids, and diaphragms may be assembled at the construction site into a rectangular basket of the specified sizes. The base, lid, and sides of the gabion are woven into a single unit. The ends and diaphragms are connected to the base section of the gabion. This connection is such that strength and flexibility at the point of connection is at least equal to that of the mesh.

All perimeter edges of the mesh forming the gabion are required to be securely selvaged with wire. This wire is required to have a diameter of not less than 0.153 in. The joints formed by tying the selvages are required to have at least the same strength as the body of mesh.

Lacing wire is supplied in sufficient quantity for securely fastening all edges of the gabion and diaphragms. Lacing wire is also used in connecting each gabion to the adjacent gabion. The diameter of the wire is required to be not be less than 0.0866 in. (Gauge 13 1/2).

GABION ASSEMBLY

The assembly, installation, and filling of gabions are the responsibility of the Contractor, but the technician is required to verify the procedure is correct. The following are assembling instructions recommended by the manufacturer:

- 1) Lay a single gabion on a hard flat surface
- 2) Stretch the gabion and stamp out all kinks
- 3) Fold the front and back panels to a right angle by stepping on the base along the crease
- 4) Fold up the end panels and diaphragms and fasten them to the front and back panels using the heavy gage wire projecting from the upper corners of each panel
- 5) Securely lace all vertical edges of ends and diaphragms. Only the connecting wire supplied for this purpose is used. The lacing procedure is as follows:
 - a. Cut a length of lacing wire approximately 1 1/2 times the distance to be laced. This length of wire may not exceed 5 ft.
 - b. Secure the wire terminal at the corner by looping and twisting

- c. Start lacing with single and double loops at approximately 5 in.
- d. Securely fasten the other lacing wire terminal

INSTALLATION

The assembled gabions are carried to the job-site and placed in their proper location. Before placing the baskets, the ground surface is required to be relatively smooth and even.

The following method applies to 3 ft high gabions:

- 1) Gabions are placed empty and laced for a stretch approximately 100 linear feet. For structural integrity, adjacent gabions are required to be laced along the perimeter of all contact surfaces.
- 2) The first gabion is firmly anchored. Anchoring may be done by partially filling the first gabion with stone.
- 3) Tension is applied to the other end with a come-a-long or other means to achieve the proper alignment.
- 4) While gabions are being stretched, all corners are inspected for open "V's" which result if corners are not properly secured. Such "V's" are required to be closed by replacing.

FILLING

The fill material is required to consist of hard, durable, clean stone, 4 to 8 in. in size.

The following procedure is required to be taken during the filling operation:

- 1) The gabions are filled in three lifts, 1 ft at a time.
- 2) Two connecting wires are placed between each lift in each cell of all exposed faces.
- 3) To protect the vertical panels from being bent during filling, rebars may be temporarily placed and laced along the upper edges. Another method is to bend a length of pliable metal and place this material over the vertical panels.

- 4) Gabions may be filled by almost any type of earth-handling equipment. Some manual stone adjustment during the filling is required to prevent undue voids.
- 5) All exposed faces are required to be hand-placed to prevent bulging and for an acceptable appearance.
- 6) The last lift of stone is required to be level with the top of the gabion.
- 7) The lids are then closed and laced to the top edges of the individual gabions and diaphragms.

ACCEPTANCE AND PAYMENT

Each shipment of gabions to a job-site is required to be accompanied by a Type C certification that states the material conforms to the requirements of the Specification. The certification is required to be on company letterhead and be signed by an officer of the company having legal authority to bind the company.

Payment is normally by the cubic yard; however, the contract should be checked to verify the payment unit.